Chapter 2
Chemical/Physical and Land Use/Cover Measurements

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Basic chemical/physical parameters should be measured at the same time that biological sampling is undertaken. These data will be used as covariates, helping to account for some of the statistical variability encountered during data analysis. The colleting and analytical procedures should follow those recommended in Standard Methods for the Examination of Water and Wastewater (APHA 1998) or accepted U.S. EPA, USGS or other operating procedures as dictated by local agencies.

Properly serviced and calibrated meters provide excellent quality data in the field. Multimeters permit reliable field measurements of parameters such as dissolved oxygen, temperature, turbidity, specific conductance and pH, but back-up water sampling containers should be taken along in case of equipment failure. The use of detailed check-box field data sheets can help ensure that all required measurements are taken and that samples are properly handled and stored during the trip. GPS coordinates for each sampling point should be recorded at the time of collection site by the field crew.

Other water chemistry parameters routinely require that water samples be collected, preserved and properly stored until they can be sent to a lab for analysis. Measurements such as soluble reactive phosphorus, ammonium-N, nitrite/nitrate-N, chloride, dissolved oxygen, temperature, turbidity, specific conductance, pH and total alkalinity should be considered and included in the sampling design if deemed relevant and budgets allow. They can provide essential information that can help determine the nutrient status of a wetland, possible sources of degradation and even which of several possible indices of biotic integrity (IBI) formulations may be most appropriate for biological assessment.

Additional measurements of chlorophyll a, total phosphorus, sulfate, redox potential (in the water column), vegetation type and stem density, and organic sediment depth (simply measured by forcing a meter stick into the organic sediments until more resistance indicates a change in consistency) should also be considered and are highly recommended. Sediment samples can also be collected and assessed in the laboratory for particle size and organic content analysis. Quality assurance/quality control procedures should follow standard operating protocols recommended by U.S. EPA, USGS, Environment Canada, or those that have been routinely used by the sponsoring agency if there is a historical record to which the surveys contribute.

Some IBIs exist in several formulations that are tied to the dominant landscape type of the wetland being sampled. In other cases, on-site assessment of land use, local disturbances, aquatic vegetation distribution and growth forms, and other local habitat features provide important complementary diagnostic information. The Great Lakes Environmental Indicator (GLEI) field teams investigating fish and invertebrate condition in wetlands developed detailed site assessment protocols using simple classification systems to assess these variables in various classes of coastal wetlands. More detailed habitat assessment protocols have been developed by the Ohio EPA for both coastal and inland wetlands. Notes on possible point sources of pollution and land cover including plant zonation should be recorded in the field note book. A good sketch, as well as on-site photos of the area, should be made as well.

General Interpretation of Covariates

Turbidity, specific conductance, and chloride should be considered to be linear, with greater values indicating disturbance. However, specific conductance values should not be interpreted as being related to anthropogenic disturbance until reaching values near 600 μS. Extreme values, either very high or very low for nitrate-N, ammonium-N, and soluble reactive phosphorus concentrations, as well as percent saturation of dissolved oxygen and pH, should be considered indicators of disturbance. With respect to inorganic dissolved nutrients, we tended to find moderate concentrations at relatively pristine sites.

Impacted sites often have either nondetectable values, because these systems are very productive and the nutrients are tied up in organic matter and sediments, or nutrient concentrations that are so high that the communities do not assimilate them as quickly as they enter the system. Also, in a system experiencing cultural eutrophication, dissolved oxygen may be as high as 180% saturated during the day when samples are collected. In this case, percent saturation likely plummets at night when only respiration is taking place in the absence of photosynthesis. Likewise, a system with organic pollutants may have very low percent saturation (e.g., 50%) of dissolved oxygen due to decomposition of excess organic matter in the absence of photosynthesis. This can be caused by siltation, cloud cover, coverage of duckweed (*Lemna* or *Spirodela* spp.) and/or turbidity. Often, pH measurements follow this relationship to some degree; a very high daytime pH may be indicative of extreme productivity, while very low daytime pH may be indicative of organic pollution.

Basic chemical/physical parameters should be measured and personal observations of disturbance should be recorded in conjunction with biotic sample collection. These data will be used as covariates, helping to account for some of the statistical variability encountered during data analysis. It is understood that logistics may preclude the collections of some of these data, but ask that as many as possible are collected.

References

APHA 1998. Standard Methods for the Examination of Water and Wastewater, 20th edition. American Public Health Association, Washington, DC.